AM Station, Technical Standards
Antenna, Directional
Rules, Amendment of
Standard Pattern, Conversion to

Part 73 of rules amended to require all AM directional stations to use standard patterns, to convert existing stations to standard patterns, and to begin the use of the metric system for AM stations. Docket No. 21473

FCC 81-45

BEFORE THE

**FEDERAL COMMUNICATIONS COMMISSION**

WASHINGTON, D.C. 20554

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| In the Matter of<br>Amendment of the Rules Governing the Conversion of Radiation Patterns for AM Broadcast Stations | Docket No. 21473 |

REPORT AND ORDER (PROCEEDING TERMINATED)

(Adopted: January 29, 1981; Released: February 9, 1981)

BY THE COMMISSION: COMMISSIONERS FERRIS, CHAIRMAN, AND BROWN NOT PARTICIPATING; COMMISSIONER QUELLO CONCURRING IN THE RESULT.

1. The Commission has before it the comments and reply comments responding to our recent *Notice of Proposed Rulemaking (NPRM)*, FCC 80-538, 45 FR 63516, in which we proposed the adoption of Rules leading to the conversion of all directional AM broadcast stations to standard patterns. This proceeding began with our *Notice of Inquiry (NOI)*, 66 FCC 2d 901 (1977). At the present time, most of the AM patterns are under the old system of theoretical patterns, measured patterns, and MEOV (Maximum Expected Operating Values). The Rules requiring the use of standard patterns for new stations and for major changes apply only to stations making application since 1971. *Report and Order in Docket No. 16222*, 27 FCC 2d 77, 20 RR 2d 1745 (1971). Currently, applicants for minor changes use the standard pattern only if they wish, with the majority continuing the use of the older types of pattern.

2. The theoretical patterns depict the radiation pattern that would occur if the station were operating under ideal circumstances. However, since such a situation does not actually occur in nature, applicants proposing theoretical patterns also propose MEOV. The MEOV are chosen based on the consulting engineer's experience and engineering

judgment, and are designed to predict the actual maximum deviations from the ideal. After construction of the station, an r.f. proof of performance is made, in which the actual pattern of the station is measured and plotted. The measured values must be within the MEOV. Under the existing system, measured values are used in allocation studies involving domestic stations while the theoretical values and MEOV are used in allocation studies involving foreign stations. Such allocation studies are tedious because of the manual adjustments that must be made to computerized calculations to consider the measured patterns and the MEOV. Since we wish to take advantage of the available technology by automating our processing as much as possible, and since there is no easy way to define the measured pattern or the MEOV with an equation which could be entered into a computer, we have concluded that the increased use of automation requires that we convert the existing stations to standard patterns. Accordingly, we issued the *NPRM* in this proceeding to examine the possibility of converting the remaining stations to standard patterns.

3. The deadline for filing comments bas November 17, 1980, and the deadline for filing reply comments was December 2, 1980. Comments were filed by the following parties:

News-Press Publishing Co.
S&S Broadcasting Co.
Association for Broadcast Engineering Standards (ABES)
A.D. Ring & Associates
William G. Ball
American Broadcasting Companies, Inc. (ABC)
KFAB Broadcasting Co.
Jefferson-Pilot Broadcasting Co.
Southern Broadcasting Co.
Association of Federal Communications Consulting Engineers (AFCCE)
Great Trails Broadcasting Corporation
WJAC, Inc.

Reply comments were filed by:

Nationwide Communications, Inc.
A.D. Ring & Associates
Westinghouse Broadcasting Co., Inc. (Group W)
American Broadcasting Companies, Inc. (ABC)
General Electric Broadcasting Co., Inc. (GEBCO)
McKenna, Wilkinson & Kittner (MWK)
Clear Channel Broadcasting Service (CCBS)
Scripps-Howard Broadcasting Co.

4. Mr. Ball wishes to make clear that he commented on his own behalf, and not on behalf of his firm. In its comments, Ring also incorporated by reference its comments in the engineering statement which it prepared as a part of the comments submitted by Jefferson-Pilot. McKenna, Wilkinson & Kittner submitted its reply comments on

behalf of its AM radio broadcast licensee clients. The comments submitted by AFCCE and Great Trails were late, but since they were submitted by the deadline for filing reply comments, we uill accept them. The comments submitted by WJAC were not submitted until December 9, 1980, a week after the deadline for filing reply comments. The reply comments submitted by Scripps-Howard were not submitted until December 5, 1980, three days after the deadline for filing reply comments. For the most part, the WJAC comments and Scripps-Howard reply comments contained much the same discussion as some of the other comments and reply comments, although there were differences in the specifics. Accordingly, we see no extra burden in considering them. Therefore, we will accept them.

5. We wish to thank those who took the time and effort to prepare the comments and reply comments on such short notice. We have analyzed them carefully and found them to be extremely helpful. Rather than discuss them at this point, we find it more appropriate to incorporate them into our discussion as we proceed. Many areas mentioned in the *NPRM* were not addressed in the comments. Except for those few instances which we will raise on our own, we will not repeat the discussion of these items, but rather will simply adopt them as proposed.

6. As mentioned in the *NPRM*, severe time constraints are imposed upon us by the need to be prepared for the Second Session of the Region 2 MF Broadcasting Conference to be held in November and December 1981. Currently, only theoretical patterns, *without* MEOV, are in the inventory of U.S. stations sent to the International Frequency Registration Board (IFRB) because the notification format makes no provision for MEOV, and manual calculations based upon plotted patterns are impractical on a region-wide basis. To retain the radiation rights which our stations now have under existing sub-regional agreements in those cases where notified MEOV and/or measured values exceed the theoretical values, we hope to notify standard patterns (with any necessary augmentation) to IFRB in time for IFRB to conduct its studies prior to the beginning of the Second Session. However, this requires that the conversion to standard patterns be completed by the end of May 1981. Most of the parties commenting recognized these time constraints. There was also general agreement that the conversation should ensure that existing protection and radiation rights not be jeopardized, and that changes in the operation of stations not be required.

7. In paragraph 7 of the *NPRM*, we discussed two possible methods of conversion of Class I and II stations where conversion to the basic standard pattern would result in a paper infringement of the secondary service area of Class I stations. Our alternatives were:

a. Convert the Class I and II stations without regard to whether there is a theoretical increase in "interference," or

b. In those cases where the standard pattern radiation exceeds the

MEOV and the measured radiation in the direction towards a Class I station's skywave service area, require the Class I or Class II station to convert to a different standard pattern which would not increase the radiation beyond that now authorized. This might be accomplished by the use of a lower Q or by negative augmentation or both. Under either alternative, we envisioned the use of the converted pattern in both allocation studies and the subsequent proof-of-performance process.

8. Jefferson-Pilot, Ring, and AFCCE present a different approach, commenting that we should convert all stations to only the basic standard pattern, without any augmentation, and that this basic standard pattern should be used for allocation purposes only. Class II stations which now do not have standard patterns would continue, in the proof-of-performance process, to be restricted in the direction towards the secondary service areas of Class I stations to the values to which they are now restricted, even if the standard pattern values are greater. This position is basically the same position that Ring took in its comments in the original rulemaking (Docket No. 16222) in which the standard pattern was adopted.

9. Ring advances four reasons for its objection to the use of complex mathematical attempts to synthesize an augmented pattern:

1. As shown by the Commission's study in the Appendix to the *NOI*, the values obtained with the basic standard pattern are quite close to the values obtained with the use of measured patterns. The differences, says Ring, quoting the *NOI*, are imperceptible.
2. The standard pattern, without either augmentation or a reduced Q,has a greater chance for international acceptance, apparently because it is simpler.
3. Conversion to a standard pattern is helpful even if it is used only as an allocations tool, and even if the limits on adjustments of the actual operation are different from the standard pattern values.
4. The Commission is laboring under a false assumption that the use of measured values of radiation are necessarily more accurate than the standard pattern values. For example, the field strength meters are generally accurate to no more than (plus or minus) five percent, the propagation curves are inaccurate, the analysis of measurement data is not perfect, and the "smoothing-in" of measured patterns between measured radials will vary with the draftsman.

AFCCE also notes rough approximations in our allocation methods, and goes on to say that conversion would be quick and inexpensive because it would only be necessary to apply the standard pattern equation to existing directional antenna parameters. These minor changes in computer programs could, we believe, be accomplished with perhaps an hour or two of effort.

10. Under the proposal advanced by Jefferson-Pilot, Ring, and AFCCE, grants of applications for changes in Class II stations would continue the restrictions on radiation which are now entered on the

construction permit, even if the standard pattern values are greater, except when the use of the standard pattern values does not cause new or additional interference to a Class I station. At the time of construction, the station would have to adjust to the standard pattern value, or the construction permit limit, if the construction permit limit is lower than the standard pattern. Ring goes further to suggest that, if a measured value is greater than the limit, and it cannot be reduced by adjustments, then the permittee would file a request for waiver, including a showing of the interference which would be created by the actual measured value. The Commission would routinely permit measured values of something on the order of 0.5 dB or 1.0 dB greater than the limit. These values were chosen, says Ring, because they are essentially the values that ue have sanctioned in the conversion that is the subject of this proceeding. Measured radiations would not be used in allocation, even if the measured values exceed the standard pattern values. In its reply comments, Ring modifies its proposal slightly to provide for use of a reduced Q and/or theoretical RMS (pattern size) for those stations which must provide wide-angle protection to skywave service areas. In these cases, Ring proposes that we accept the fact that the allocation of a facility with a particular pattern and power will cause a certain amount of interference to other stations. Therefore, when there is a deep suppression in an angular sector of 20 degrees or more, Ring proposes that the average radiation over the sector not exceed the standard pattern value (computed with a reduced Q and/or lower theoretical RMS, if necessary), and that the maximum excursion for any measured radial shall not exceed the standard pattern value by more than 3 dB. AFCCE, on the other hand, would permit augmentation to be used by applicants proposing changes after the conversion.

11. CCBS was the only party to submit an engineering study of the impact of conversion on Class I stations. Because the short period for comments and reply comments precluded a complete study, CCBS studied one case which it considered typical. KRVN, Lexington, Nebraska, 880 kHz, is a Class II-A station operating co-channel with Class I-A station WCBS, New York, New York. Based on the KRVN MEOV, KRVN does not cause interference within the 0.5 mV/m-50 percent skywave contour of WCBS. However, on the site-to-site bearing, the KRVN basic standard pattern radiation (without augmentation or a reduced Q) would cause interference within the WCBS 0.5 mV/m-50 percent contour up to the 0.7 mV/m-50 percent contour. The WCBS service area in this direction would be reduced from 780 miles to 640 miles. CCBS expects that a study of the other Class II-A stations would reveal similar results; we agree.

12. CCBS also points out that, on the Class I-B channels, more than one station would convert to standard patterns. Not only would each station possibly infringe on the secondary service area of the Class I-B station, but there would possibly be a cumulative impact as well.

13. Therefore, CCBS proposes that we adopt what is, in effect, the proposal by Jefferson-Pilot, Ring, and AFCCE. If that is not possible, CCBS asks that we adopt our alternative b, in paragraph 7, above, requiring the use of a reduced Q and/or augmentation to avoid increasing radiation, on paper, towards the skywave service areas of the Class I stations.

14. In its reply comments, ABC takes issue with Ring's proposal, noting that it would continue to embody a dual-pattern concept which is contrary to the purpose of conversion. (See our *Further Notice of Proposed Rulemaking in Docket No. 16222*, 34 FR 18942 at para. 66 (1969).) ABC also notes that use of a standard pattern for allocation purposes only would mean that a station, with more restrictive limits on adjustments than depicted by the standard pattern would be afforded protection outside of their actual service areas, possibly precluding new stations. ABC also raises several unanswered questions concerning Ring's proposal. Finally, ABC states that it is not convinced by Ring's arguments that an essentially theoretical representation is necessarily more correct than a statistically good measurement of fact.

15. We have considered the alternative proposals advanced by Jefferson-Pilot, Ring, AFCCE, and CCBS, and have concluded that they are not acceptable. We base our determination on both international and domestic considerations.

16. We assume that the proposed Region 2 agreement will include essentially the same interference criteria that are included in the *Report of the First Session*. (A copy of the *Report* appears as Appendix I to the *Further Notice of Proposed Rulemaking in BC Docket No. 79-166*, FCC 80-622, released November 25, 1980.) The *Report* defines three classes of station for Region 2 purposes. Class "A" is one of the newly defined Region 2 classes. In the inventory which the U.S. sent to the IFRB, we specified all of the U.S. Class I stations, plus two Class II stations in Alaska, as Class A stations. U.S. Class A stations will be protected in a manner which is different from that in our present Rules, the North American Regional Broadcasting Agreement (NARBA), and the "Agreement Between the United States of America and the United Mexican States Concerning Radio Broadcasting in the Standard Broadcasting Band (535–1605 kHz); (Mexican Agreement). Under the proposed standards, U.S. Class A stations are protected by certain countries (including some of our geographically close neighbors such as Cuba) by the use of RSS calculations on the 0.5 mV/m-50 percent contours. See paragraph 2.3.3.2 of the *Report*. The RSS calculations will include U.S. Class I and Class II stations with the patterns which are in the inventory sent to the IFRB. If we adopt this proposal and notify only the basic standard pattern without augmentation, then the values used in computing nighttime limitations from U.S. Class I and II stations will be inflated beyond the actual values. With higher limitations from U.S. stations, the RSS at points on a Class A station's 0.5 mV/m-50 percent contour will be higher, thereby

allowing stations from certain foreign countries to radiate more towards the secondary service area of a Class A station than would be permitted if we had used negative augmentation or a reduced Q in computing the patterns for U.S. Class I and Class II stations. We believe that full protection of the secondary service areas of our Class-A stations in the international arena requires that we use negative augmentation, or a reduced Q, to reduce the calculated radiation to values which more accurately depict adjusted values of radiation. This reasoning leads us to choose our alternative b, rather than alternative a or the modifications suggested in the comments.

17. From a purely domestic standpoint, there is an additional reason why the proposals of Jefferson-Pilot, Ring, and CCBS are unacceptable. The "dual-pattern" approach inherent in those proposals could result in increased interference to the nighttime groundwave service areas of Class I stations. In areas not engulfed by its 0.5 mV/m-50 percent skywave contour, the nighttime groundwave 0.5 mV/m contour of a Class I station is protected on an RSS basis. If the RSS (based on the basic standard pattern, without augmentation or a reduced Q) is less than 0.5 mV/m, a co-channel station applying for a change in facilities could be granted an increase in its adjustment tolerance (MEOV) which would raise the RSS to 0.5 mV/m. However, after grant, the newly granted MEOV would no longer be used in computing the RSS; only the standard pattern value would be used. Thus, any station subsequently proposing a similar increase in its radiation toward the Class I station's primary service area would be permitted a larger increase than would otherwise prevail under a single pattern system. Each successive application could add to the cumulative degradation of the Class I station's primary service area, while calculations pursuant to these proposals would reveal apparently adequate protection, thus masking the actual interference.

18. Also, under these proposals, applications for changes by stations which are on U.S. clear channels would have to be prepared and studied using the present manual methods. While it is true that the calculation of the location of the protected 0.5 mV/m-50 percent contour would be automated, calculation of the allowable horizontal plane radiation from an applicant co-channel Class I or Class II station would continue to require manual calculations and engineering judgment. And the most difficult applications to study manually are those involving protection of a Class I station's secondary service area. Since it is precisely these manual studies which we are trying to eliminate, ue find that these proposals are not acceptable because they would continue many of the presently burdensome manual studies, thus failing to achieve the full level of automation potential we are seeking in this proceeding.

19. Some of the comments were written as though only Class II stations would be required to use negative augmentation and/or a reduced Q to protect the secondary service areas of Class I stations. We

believe that the Class I stations must also use a reduced Q and/or negative augmentation, if necessary, to protect the secondary service area of another, co-channel Class I station. Consider, for example, the two Class I-B stations on 1090 kHz. The 0.025 mV/m-10 percent contour of KAAY, Little Rock, Arkansas, "kisses" the 0.5 mV/m-50 percent contour of WBAL, Baltimore, Maryland, for several hundred miles, and vice-versa. Conversion of both KAAY and WBAL to standard patterns without negative augmentation and/or a reduced Q would result in significant paper increases in mutual interference. Accordingly, the Rules we adopt today regarding protection of Class I stations apply to Class I as well as Class II stations.

20. The proposal by Ring and AFCCE concerning the use of the basic standard pattern, discussed above, does not apply only to Class II stations. They also propose that Class III stations be converted to simply the basic standard pattern, without the use of negative augmentation and/or a reduced Q. Furthermore, the basic standard pattern would be used only for allocation purposes, and not in the proof-of-performance process. AFCCE would continue the present limitations on the authorizations of the Class III stations. Ring, on the other hand, would restrict the actual adjustment of Class III stations to the basic standard pattern values, allowing the same types of tolerance (0.5 dB or 1.0 dB). Taking a different approach, ABES suggests that use of negative augmentation or a reduced Q may be appropriate for Class III stations as well as those on the clear channels.

21. One of the reasons that we are so concerned with the standard pattern (as augmented) encompassing the actual, measured pattern is because of our present and proposed international agreements. Although these agreements deal with frequency, channel spacing, protected service areas, etc., the bottom line of any such agreement is radiation rights or limits. If we were to permit stations to radiate, in fact, more than is permitted pursuant to an agreement, then we have struck at the heart of the agreement. Detailed studies and extensive negotiations with other countries lead to the limits on radiation. We cannot reach an agreement and then permit stations to radiate more than the values which were agreed upon in our negotiations. To do so would be a violation of both the letter and the spirit of the agreement. CCBS comments that concerns such as these are valid only if other countries also agree to restrict the actual radiation from their stations to the values which are used in the studies and the negotiations. Otherwise, says CCBS, U.S. stations with standard patterns will provide more protection to foreign stations than they receive from foreign stations. CCBS did not discuss the minor, but nonetheless important, point that the protected service areas of U.S. stations are increased by use of the standard pattern.

22. Great Trails notes that the measured pattern of its station, WCII, Louisville, Kentucky, 1080 kHz, exceeds the basic standard pattern, and that if a non-augmented pattern superseded the currently

authorized pattern, then WCII could not conform to our Rules. Moreover, the international implications are perceived by Great Trails to be significant, particularly if the channel spacing is shifted to 9 kHz from the present 10 kHz. Readjustments (if a shift to 9 kHz spacing is required) and the potential for power increases require the use of augmentation to retain the presently authorized radiation limits and to maintain maximum flexibility. It also points out that there are many other stations, in addition to WCII, which fall into this category. WJAC makes similar comments.

23. Nationwide, in its reply comments, continues this argument, particularly with regard to the international implications. Nationwide, the licensee of WLEE, Richmond, Virginia, 1480 kHz, and WGAR, Cleveland, Ohio, 1220 kHz, notes that it wishes to increase the power of WLEE above its present five kilowatts, should the Region 2 agreement and the implementing amendments to our Rules permit such an increase. To preserve the flexibility for the potential power increase, WLEE wishes to retain the presently authorized radiation values in the form of an augmented standard pattern. Paragraph B(2)(f) of Annex II of the Mexican Agreement provides that WGAR not increase its radiation over the current value in the arc from 193 degrees true to 264 degrees true. Conversion to the basic standard pattern would, according to Nationwide, reduce the WGAR radiation in this arc, thus losing current internationally recognized radiation rights. Recent power line construction makes it essential that WGAR retain its present flexibility in adjusting its pattern, argues Nationwide. Scripps-Howard echoes these comments with respect to its stations, WMC, Memphis, Tennessee, 790 kHz; and WNOX, Knoxville, Tennessee, 990 kHz.

24. After giving a great deal of thought to the alternative proposals presented in the comments, we conclude that we must remain with our original proposal. Ring's proposal does not provide an acceptable method of dealing with those stations whose existing measured patterns exceed the basic standard pattern by more than 0.5 dB or 1.0 dB. And it would apparently lead to the need for augmentation analysis, in any event, for those stations whose measured patterns exceed the basic standard pattern by more than 1.0 dB, assuming that we honor our desire to avoid readjustments of directional antennas as part of this proceeding. Ring suggests the use of a waiver process in these cases. However, that only adds complexity and delay to the final licensing process, adding further burdens to the Commission staff where speed, automation, and a reduction in manual processing are our goals. Furthermore, with augmentation, it is less likely that the measured values uill exceed authorized values. Similarly, the AFCCE proposal does not provide an acceptable method of dealing with those stations whose existing measured patterns exceed the basic standard pattern by any amount. Moreover, neither provides a means by which MEOV in excess of the basic standard pattern can be

retained internationally. Also, the use of a tolerance of 0.5 dB or 1.0 dB (or even 3.0 dB in the case of protection of Class I stations) is tantamount to changing the value of 1.05 in the standard pattern formula, to 1.18, for example, if a 1.0 dB tolerance is allowed. It must be remembered that the basic standard pattern formula already includes a five percent tolerance plus the value of Q added in quadrature. We see no need to add a tolerance to a tolerance, which would result in an actual tolerance of 18 percent, in the case of 1.0 dB. Also, with the use of a 3.0 dB tolerance over arcs of 20 degrees or more, as proposed by Ring for certain stations, we see an added element of complexity, not a reduction of complexity. The Ring method also masks interference. We previously discussed how the dual-pattern approach not only allows cumulative increases in interference to the nighttime 0.5 mV/m primary groundwave service area of a Class I station, but also shows no apparent degradation. An analogous analysis would lead to a similar conclusion in the case of a Class II or Class III-A station with an RSS below 2.5 mV/m or a Class III-B station with an RSS below 4.0 mV/m. Finally, both methods would lead to violations of both our present and proposed international agreements if the measured values exceeded the basic standard pattern. We will not adopt rules which will lead to certain violations of our present and proposed international agreements.

25. With regard to the ABES proposal for use of a reduced Q and/or negative augmentation for Class III stations, we first note that the suggestion was not supported by any studies showing the need for such additional compensation. Indeed, our study in the Appendix to the *NOI, supra,* showed relatively small changes as a result of conversion of Class III stations. Accordingly, we conclude that negative augmentation and/or a reduced Q should not be used in converting Class III stations, except when required by international considerations. The distinction between the method of handling Class III stations and those on the clear channels relates to the different methods of protection. The change in service area of a Class I station as a result of an increase in radiation towards the Class I station's secondary service area is greater than the change in service area of a Class II or Class III station as a result of the same increase in radiation. This is because the Class I station has a skywave service area protected on a single signal basis while a Class II or Class III station has a groundwave service area protected on an RSS basis.

26. The conversion to the standard pattern would begin by use of the existing theoretical RMS to determine the size of the pattern. Contrary to the statements by S&S, the theoretical RMS would not normally correspond to the RMS achieved with an assumed loss resistance of one ohm per tower. However, we did discuss the possibility of reducing the theoretical RMS for those stations where it appears to be unrealistically high. See paragraphs 24 and 25 of the *NPRM*. Specifically, we proposed that the theoretical RMS used with

the standard pattern be restricted so that it is no greater than 3.9 percent more than the no loss or one-ohm-loss RMS for stations with nominal powers of five kilowatts or less, and no greater than 2.6 percent more than the no loss or one-ohm-loss RMS for stations with nominal powers above five kilowatts.

27. ABES supports the general concept of restricting the RMS in those cases where it is unreasonably high, but did not comment on the specifics. Mr. Ball favors the required reduction in RMS if the r.f. proof of performance is more than 10 years old, or if it does not include non-directional measurements with sufficient close-in points. However, we would allow three to five years for the station to submit a new proof to recapture the higher RMS. ABC suggests that some stations have an efficiency which is higher than predicted, noting that two of its stations have recent proofs showing higher RMS than predicted. ABC also points out that the older proofs for these stations indicate higher RMS. Therefore, in those cases where the theoretical RMS is greater than the measured RMS, ABC would use the greater of the measured and the one-ohm loss RMS. But if the measured RMS is greater than the theoretical RMS, or the one-ohm-loss RMS, ABC uould evaluate the proof. If the proof were made within the last 10 years, ABC would retain the RMS in the proof. However, if the proof were over 10 years old, ABC would reduce the RMS to the lesser of the one-ohm-loss RMS and the theoretical RMS. KFAB is concerned about the impact of reducing the RMS of its station, KFAB, Omaha, Nebraska, 1110 kHz, since its measured RMS is greater than the no-loss RMS. Therefore, says KFAB, it would have to augment over the entire main lobe to retain the measured and notified values of radiation. Group W is concerned about one of its stations, WINS, New York, New York, 1010 kHz. Its theoretical, notified RMS is greater than would be permitted under our proposal. Therefore, augmentation would have to be applied in its major lobe. Jefferson-Pilot (and Ring via its incorporation by reference) suggests that taller towers have an actual efficiency which is higher than predicted because of the lower propagation velocity in the towers. When the propagation velocity is properly considered, says Jefferson-Pilot, the measured pattern would fit within the standard pattern. Jefferson-Pilot suggests that we modify our Rules to take account of the differences in propagation velocity and its impact on tall towers. In its reply comments, Ring specifically requests that we modify the formulas in proposed Section 73.160 to take account of a standard propagation velocity equal to 93 percent of the speed of light. New-Press, licensee of KTMS, Santa Barbara, California, 1250 kHz, also points out that a velocity factor should be considered, although News-Press indicates that it could be as low as 0.87.

28. We have analyzed the comments, particularly those dealing with the differences in propagation velocity, and have concluded that additional study is required. Ue would like to issue a *Further Notice of Proposed Rulemaking* to examine this issue in more detail so that we

might reach a decision prior to the conversion. However, in view of the international time constraints involving our preparation for the Second Session, we do not have that luxury. The international time constraints also preclude implementation of Mr. Ball's proposal to allow three to five years to recapture a higher RMS. Therefore, we will convert the stations to standard patterns using the authorized theoretical RMS, and we will not pursue the matter of reducing excessively high RMS values in this proceeding. Also, we will adopt the formulas in Section 73.160 as proposed. Special cases can be handled pursuant to Section 73.160(c). We intend to revisit this issue in a separate proceeding, however, when time permits.

29. Group W, with respect to WINS, presents the situation where the MEOV specified on the construction permit is greater, at a particular azimuth, than the MEOV (if any) on the actual plotted pattern authorized by that construction permit. In these cases, the greater value will control, and should be used in developing augmentation parameters. However, when the MEOV on the construction permit is specified only at an individual azimuth, it would appear that the augmentation would be an infinitely thin spike. Since that, if course, is unreasonable, we will adopt our proposal that a span of 10 degrees be used in these circumstances. Indeed, we believe that a span with a minimum of 10 degrees should be used in all cases.

30. Scripps-Howard is concerned that the conversion will not take into account the outstanding construction permit for WMC. That construction permit involves only changes in MEOV, and Scripps-Howard wants to ensure that the MEOV on the permit are not overlooked. They will not be. The conversion will be performed separately for each existing or proposed operation. The conversion of a station's daytime licensed operation, for example, will be independent of the conversion of its daytime construction permit operation. There will be no attempts during the conversion to combine a licensed and construction permit operation into a single operation. It should be noted, however, that the conversion for a licensed operation will consider the construction permit limits associated with that license; these limits are different than those on the outstanding construction permit.

31. In paragraph 11 of the *NPRM*, we discussed the effect of conversion on certain Class III stations. These stations, which operate with a nighttime nominal power of one kilowatt, could be changed from Class III-A to Class III-B stations, or vice-versa, if the RSS moves above or below 2.5 mV/m as a result of the conversion. A Class III-A station may have its RSS raised no higher than 2.5 mV/m, while a Class III-B station may have its RSS raised to as much as 4.0 mV/m. (A Class III station with an existing RSS higher than 2.5 mV/m or 4.0 mV/m, depending on whether it is a Class III-A or Class III-B station, is protected against any increases in RSS.) The determination of whether a station is a Class III-A station or a Class III-B station

depends on whether its RSS is above or below 2.5 mV/m. Our proposed Rules would simply redefine all Class III stations with a nighttime power of one kilowatt to be Class III-A stations. This would provide additional protection to those stations which are currently Class III-B stations with an RSS between 2.5 mV/m and 4.0 mV/m, but would not affect any other stations.

32. ABES agrees with our proposal, while ABC agrees with the proposal made by Kenneth Williams in his comments in response to our *Notice of Inquiry* in this proceeding. As discussed in paragraph 11 of the *NPRM*, Mr. Williams, and now ABC, prefer that we determine whether a particular Class III station is presently a Class III-A or a Class III-B station. This determination would become a part of its license, and the RSS of the station after conversion would be irrelevant to its class. ABC suggests that calculation of the RSS for the affected stations would not be time-consuming, and also suggests that the licensees may be willing to assist with the calculations, providing that the Commission cooperate by making recently filed night studies and current measured patterns somewhat more easily available than they presently are. GEBCO and MWK both state, without specifically referring to this issue, that they favor conversion to standard patterns if, among other things, conversion can be accomplished without changing the classification of any station or the level of protection against interference to which it is now entitled.

33. There are approximately 600 Class III stations with a nighttime power of one kilowatt. Computing the RSS of each of these stations by current methods would, be believe, indeed be time-consuming. There would have to be adjustments for measured patterns, which is the very practice we are trying to eliminate in this proceeding. Again, looking at the time constraints related to preparation for the Second Session, we must conclude that our proposal to redefine the stations as Class III-A stations should be adopted. We again note that there would be no impact on existing stations, except that those converting from Class III-B to Class III-A would receive even more protection than they do at present. New stations and changes in existing stations may be slightly more restricted than they are now because they will now have to protect an RSS below 4.0 mV/m, instead of 4.0 mV/m, in some cases. We believe that the improvements in protection requirements (resulting from reclassification from Class III-B to Class III-A) will not be objectionable to GEBCO and MWK.

34. Since the Commission does not have adequate staff to perform the conversion to standard patterns within the internationally imposed time constraints, and since it would be an administrative nightmare to attempt to have each station perform its own conversion in such a short time, we concluded that the only feasible method of performing the conversion is with a contractor. Except for AFCCE, all parties commenting on this issue agreed that the only method, given the restrictive time frame, is with the use of a contractor. As discussed

above, AFCCE has proposed a method of conversion (to only the basic standard pattern) that would require only minimal effort to complete. Therefore, AFCCE believes that a contract is unnecessary; we agree that a contract would be unnecessary if we followed the AFCCE proposal. However, AFCCE does agree that the use of a contractor would be the only feasible method of performing the conversion if we follow the approach outlined in the *NPRM*. We have decided to do just that, except for eliminating the reduction of apparently excessively high RMS values.

35. S&S suggests that the Commission staff bould be the only beneficiary of the conversion. However, ABC points out that the benefits of conversion would accrue both to neu applicants and to the Commission. We would note, also, that existing stations benefit to the extent that they are better protected from interference from foreign stations and by virtue of retention of their existing radiation rights which would otherwise be lost internationally. And existing stations would, of course, benefit if the licensee were a party to a change in operation. Apparently because we were silent about responsibility for funding in our *NPRM*, ABC felt it prudent to suggest that the Commission, rather than the individual licensees, pay for the conversion by the contractor. Since we originally intended that the Commission pay for the conversion, although not stated in the *NPRM*, we have no objection to stating unequivocally that the Commission will pay for the contractor to perform the conversion.

36. Similarly, because of the short time, there was general agreement that a conversion by frequency would be preferable to conversion over the renewal cycle.

37. Several of the parties, while agreeing that the use of a contractor would be appropriate, noted that it would be necessary to have a means by which the individual stations would be able to receive the parameters developed by the contractor, and have a time to request modifications in the parameters. ABC also suggests that private negotiations between affected parties may be appropriate in certain circumstances. We agree that a notification would be beneficial. Indeed, in our solicitation directed to prospective contractors, we included a notification procedure as one of the tasks to be performed. Our solicitation included the following:

> a. The contractor shall prepare a Public Notice announcing the new parameters.
>
> b. The Commission will distribute the Public Notice via our Public Information Office.
>
> c. Any party (licensees, permittees, applicants, or others) may submit proposed corrections to the developed parameters within 30 days after publication by the Commission. The proposed corrections would be submitted both to the Commission and to the contractor. In addition, if the request for modification came from

a party other than the licensee, the party would also have to notify the licensee.

d. If a modification is requested, the contractor would examine the request and either modify the parameters (including preparation of another Public Notice which the Commission would distribute) or supply a report to the Commission indicating why the contractor believes the original parameters are correct.

e. In the event that the contractor supplies a report to the Commission, Commission staff would examine both the request for the modified parameters and the contractor's report, and make a decision.

We will explicitly include the above procedures in our conversion procedures in Appendix II, along with the additional requirement that any party requesting modifications must justify the request. We will also add the requirement that any party requesting modifications must supply alternative parameters; it will not be sufficient to simply state that the parameters developed by the contractor do not please the party requesting modifications. We have included the above requirement because the international time constraints require that we adopt parameters as quickly as possible. Also, it is important to note that the Commission, not the contractor, would be the final arbiter. We have no objection to the ABC suggestion concerning negotiations between affected parties, provided that such negotiations do not require extension of the 30-day period for modification. Parameters developed by the contractor will be considered final, constitute a legal modification of the station license under Section 316 of the Communications Act of 1934, as amended, and will be provided to the IFRB in the absence of requests for modified parameters within the 30-day period prescribed by the guidelines for conversion.

38. Group W has investigated the situation involving WINS. Noting that the WINS standard pattern would have to be augmented in at least six directions to retain the values specified on the WINS construction permit, Group W suggests that when the MEOV (either on the pattern or the construction permit) is within 10 percent of the standard pattern, negative augmentation to reduce the pattern to the MEOV not be required. The situation postulated by WINS would also require the use of negative augmentation to avoid further infringement of the Canadian border.

39. We noted in paragraph 33 of the *NPRM* our ongoing discussions with Canada concerning an agreement whereby both countries would use the standard pattern for international purposes. (The U.S. already uses standard patterns internationally for new stations and major changes. Canada is already using the standard pattern domestically.) We believe that a formal agreement with Canada is in the immediate future. (We already have an informal agreement that our conversion to standard patterns need only consider the MEOV in the horizontal plane in determining the allowable radiation.) Since we are

so close to an agreement, and since we anticipate that the agreement will be reached by the time the conversion beging, we do not believe that it is necessary to provide for negative augmentation to avoid increasing radiation over what is now notified. Rather, augmentation will be used only to retain existing MEOV which exceed the basic standard pattern values. Therefore, Group W's request to allow retention of full standard pattern values when the MEOV are within 10 percent of the standard pattern values is moot.

40. We are in the preliminary discussion stage concerning a possible standard pattern agreement with Mexico. We also hope to reach an agreement with Mexico by the time conversion begins. Therefore, we see no need to use negative augmentation in the direction of Mexican stations to avoid increasing radiation beyond that now notified.

41. In the preceding two paragraphs, we concluded that we did not need to use negative augmentation in the direction of Canadian and Mexican stations because we are acting on the assumption that we will reach agreements on standard pattern conversion with the two countries. In the event that we do not reach such agreements, we intend, without further rulemaking, to have the contractor performing the conversions use negative augmentation as necessary to avoid increases in radiation beyond that now notified.

42. Although negative augmentation need not be used in the direction of Canadian and Mexican stations, it remains necessary to use negative augmentation in the direction of stations in the other countries with which we have agreements. However, we note that the U.S. will attempt to have the Second Session adopt the standard pattern (with augmentation) for use throughout Region 2. However, even if that attempt is unsuccessful, agreements with Canada and Mexico should satisfy the concern of CCBS that the use of standard patterns by only U.S. stations puts U.S. stations in a position of providing more protection to foreign stations than the foreign stations provide to U.S. stations. We reach this conclusion because the overwhelming majority of directional antenna stations which are close enough to affect U.S. stations are located primarily in Canada and secondarily in Mexico. Following is a tabulation of the number of directional stations operated in other countries in Region 2, as supplied to the IFRB as of May 31, 1980; countries which are not listed do not have any directional operations.

| | |
|---|---|
| Argentina | 2 |
| Brazil | 96 |
| British West Indies | 3 |
| Haiti | 4 |
| Netherlands Antilles | 1 |
| Santa Lucia | 1 |
| Uruguay | 17 |
| Venezuela | 9 |

43. There is another area of concern involving the international

aspects. There may be some cases where the measured patterns of U.S. stations exceed the notified patterns in the direction of foreign stations. KFAB and Group W (with respect to WINS) both present examples where the measured values exceed the notified values in some directions, and they wish to ensure that they retain the right to operate with their present measured patterns. Measured patterns which exceed notified patterns are in technical violation of our agreements with foreign countries. Under present policies, such measured patterns would not be authorized.

44. In a sense, the problem of measured radiation exceeding notified radiation is outside the scope of this proceeding; we would have this problem even if we were not converting to standard patterns. However, we believe that it is appropriate to attempt a resolution in this proceeding. As noted above, one of our early reasons for proposing the standard pattern was to eliminate the use of multiple, conflicting patterns. Therefore, we do not consider the use of a notified pattern which differs from the domestically authorized pattern to be an acceptable situation.

45. There are two potential solutions:

a. Require each station with such a measured pattern to readjust and perform a new proof of performance to bring the measured pattern within the notified pattern.

b. Notify the converted pattern (uith the measured radiation used in developing the converted pattern) and, where necessary, negotiate to resolve the problems.

46. We believe that alternative b is more appropriate for several reasons. First, not every case where the measured radiation exceeds the notified radiation will result in objectionable interference. Second, we are attempting to accomplish this conversion without requiring adjustment of any stations. If we used alternative a, some stations would be readjusting without a true requirement for doing so. Finally, we have readily available forums for negotiations, in the form of bilateral discussions with Canada and Mexico, and the upcoming Second Session.

47. In paragraph 29 of the *NPRM*, we discussed whether it is necessary to replot all of the stacked and vertical slice patterns. We noted that our position was that the plots are unnecessary, except for the horizontal plane pattern. However, our international agreements require the use of the plotted patterns. Since the issuance of the *NPRM*, we have reached an agreement bith Canada that the plotted patterns are no longer required. We have not yet reached similar agreements with other countries. Until we do, in order to maintain continuity of our past practices, we will continue to require that the plotted patterns be submitted and to continue to notify them to the other countries. However, we do not plan to replot the converted patterns until after the Second Session reaches a determination on whether to change the channel spacing from 10 kHz to 9 kHz. Even

then, replotting may be unnecessary internationally because the proposed notification format for Region 2 does not require plotted patterns. In any event, we do not have to decide in this proceeding the details of a potential replotting after the decision on channel spacing is reached.

48. As noted throughout this proceeding, minor change applicants are not now required to propose a standard pattern, unless modifying an existing standard pattern. As a result of this proceeding, minor change applicants will have to submit standard patterns with appropriate augmentation. Any amendments must also include standard patterns. We will make the effective date of this requirement correspond with the effective date of the other rules adopted in this proceeding.

49. In the past, we have occasionally waived the required use of a standard pattern for a proposed neb Class II-A station or for a Class II-A station wishing to make a major change. As a result of the conversion, all stations (including the Class II-A stations for which waivers were granted) will have standard patterns. We do not intend to grant waivers of this nature in the future because we do not desire to return to non-automated patterns. We note that we have provided for the use of a reduced Q in certain instances. *Report and Order in Docket No. 16222, supra,* at para. 40. We do not intend that negative augmentation be used except during the conversion and when making changes to those stations which have negative augmentation as a result of that conversion.

50. At the same time that we convert to standard patterns, we proposed to convert to the metric system. In paragraph 12 of the *NPRM*, we raised a couple of questions concerning the units to be used. For instance, the radiation from the patterns is now given in millivolts per meter (mV/m) at one mile. Since the new propagation curves adopted for Region 2 are labeled in dBu, should we remain with mV/m or switch to decibels above one microvolt per meter? Should re remain with the radiation at one mile or convert to radiation at one kilometer? ABES, Mr. Ball, and ABC stated their preference for mV/m rather than dBu. Mr. Ball and ABC noted that the field strength meters have their scales labeled in mV/m and that a conversion to dBu would lead to unnecessary confusion in meter readings. A slight preference for the linear feature of mV/m rather than the logarithmic scale of dBu was also expressed. The Commission has no particular preference for one over the other; we are therefore adopting Rules which use mV/m since that is the consensus of the comments. Although personally opposed to the use of the metric system, Mr. Ball recognizes the inevitability of conversion. He therefore favors the specification of radiation at one kilometer rather than one mile. ABC, on the other hand, would convert one mile to 1.6 kilometers, and use the radiation at 1.6 kilometers. This, says ABC, would continue the use of values of radiation with which we are all familiar. We have considered the comments, and have concluded

that a simple conversion from one mile to 1.6 kilometers would not be a true conversion to the metric system. Therefore, we will require the use of radiation at one kilometer rather than at one mile. We note that this will change the formula for Q for the standard pattern (Section 73.150). Instead of 6.0 times the square root of the nominal power, we would have 9.656 times the square root of the nominal power. For the sake of simplicity, we will use 10.0 rather than 9.656; the change is negligible.

51. We initially included the metric conversion in this proceeding because we did not want to have two conversions, a conversion to standard patterns and then another conversion to the metric system. This is particularly important if ue are to replot all of the patterns. However, since we have decided not to replot the patterns until at least 1982, there is no administrative reason why the two conversions must take place simultaneously. Accordingly, we will convert to the metric system at a later date, after all stations have been converted to standard patterns. We have set the date, January 4, 1982, sufficiently far in the future so that we will have time to convert our application and authorization forms, and so that we and consulting engineers will have time to modify our computer programs.

52. We also discussed the use of parameters which are specified with unrealizable precision. Related to this issue is the format in which the parameters should be specified. We proposed limiting the number of significant figures to values no greater than can be obtained with available equipment. ABC doesn't like unnecessary limitations on the precision, but sees the entire issue as a "tempest in a teapot." ABC, therefore, sees neither good nor harm in requiring the numbers to be rounded off. Both ABC and Mr. Ball suggest that the spacing and orientation of the towers be specified from a common origin. They oppose our suggestion (in paragraph 31 of the *NPRM*) that we permit a description of a parallelogram which describes only the sides. ABC and Mr. Ball state that such descriptions would result in loss of some of the benefits of computerization, with ABC stating that a single reference point is necessary for use in a generalized computer program. We disagree. For some years, we have been using computer programs which permit the sides of a parallelogram to be specified. The spacing and orientation of each tower may be specified from either a common origin or from the previous tower. If the spacing and origin are specified from the previous tower, the computer program (not the engineer) calculates the actual spacing and orientation from the common origin for use in the remainder of the calculations. We have found that such a feature is not difficult to use, and the coding for such calculations is quite short. Therefore, we see no reason to depart from our initial conclusion that a simpler description of a parallelogram results from describing its sides. We suggest that modifications to existing computer programs to incorporate such a feature ould make them more versatile. Appendix III is a listing of our subroutine which

performs the calculations. Consultants and others should feel free to adapt it for use in their programs.

53. Throughout this proceeding, the only issue which might have required actual adjustments of, or measurements on, directional antenna systems is that relating to the possible reduction of an excessively high RMS. Since we have postponed a decision on that issue, it is clear that the full conversion to standard patterns and the metric system will not require changes in operation by existing stations.

54. Since actual changes in operation will not be required, it may appear that monitoring point values will remain unchanged. On the other hand, since the allowable radiation may change somewhat from what is presently authorized, and since the monitoring point values are based on the ratio of authorized to measured radiation, it may appear that some monitoring point values should be changed as a result of the conversion. Because we are attempting to accomplish this change with as little disruption as possible, we believe that it is appropriate that we not change any monitoring point values during the conversion. However, the public notice announcing the parameters developed during the conversion will include a listing of the pre- and post-conversion radiation on the monitor point radials.

55. In accordance with our discussion above, we have modified the guidelines for conversion which appeared in Appendix I of the *NPRM.* The modified guidelines, which will be followed by the contractor in performing the conversion, now appear as Appendix II to this *Report and Order*. We hope to issue the contract by the end of February 1981, and begin conversion as soon as possible thereafter.

56. We recognize that, in some cases, there will be "paper" changes in the interference which a station may receive as a result of the conversion. Although in this proceeding ue are not actually withdrawing existing service to the public, we are establishing rules which may, in some instances, permit antenna adjustments which ultimately may result in additional interference. Since any subsequent changes in antenna adjustments will be in accordance with the rules established herein, they will not constitute a modification of license under Section 316 of the Communications Act of 1934, as amended. *WBEN, Inc. v. United States*, 396 F. 2d 601 (2nd Cir. 1968). Accordingly, hearings at the time of actual individual changes are not required and are not anticipated. In view of the detailed nature of this proceeding and its international ramifications, we are confident that the Broadcast Bureau can expeditiously resolve disputes which may arise as a result of the conversion process. Accordingly, we delegate to the Chief, Broadcast Bureau, such authority.

57. Accordingly, under the authority of Sections 4(i), 303(f, g, r), and 307(b) of the Communications Act of 1934, as amended, IT IS ORDERED that, effective March 17, 1981, Part 73 of the Commission's

Rules and Regulations is amended in accordance with attached Appendix I.

58. IT IS FURTHER ORDERED that this proceeding is terminated.

FEDERAL COMMUNICATIONS COMMISSION,
WILLIAM J. TRICARICO, *Secretary.*

Appendix I

I. Section 73.21(b)(1)(ii) is amended to read as follows:

Section 73.21 Classes of AM Broadcast Channels and Stations.
(a) * * *
(b) * * *

(1) * * *
(i) * * *

(ii) *Class III-B station.* A Class III-B station is a Class III station which operates with a nighttime nominal power of 500 watts, and a daytime nominal power no less than 500 watts and no greater than 5 kilowatts. The service area of a Class III-B station is subject to interference in accordance with Section 73.182.
(c) * * *

II. Section 73.150 is amended as follows:

1. The Note to Section 73.150(a) is amended to read as follows:

(a) * * *

Note: Applications for new stations and for changes (both minor and major) in existing stations must use a standard pattern.

2. The portion of Section 73.150(b)(1)(i) which currently begins:

"$f_i(\theta)$ represents the vertical plane * * *"
and concludes
"See also Section 73.190, Figure 5."

is amended to replace it with the following:

$f_i(\theta)$ represents the vertical plane radiation characteristic of the $i^{th}$ antenna. This value depends on the tower height, as well as whether the tower is top-loaded or sectionalized. The various formulas for computing $f_i(\theta)$ are given in Section 73.160.

3. The portion of Section 73.150(b)(1)(i) which currently begins:

"Q is the greater of the following two quantities:"
and concludes:
"6.0 $g(\theta)$ $\sqrt{P_{kw}}$"

is amended to replace it with the following:

The method of computing Q depends on whether the metric system is being used; see Section 73.181(f). For all situations prior to January 4, 1982, Q is the greater of the following quantities:

$$0.025\ g(\theta)\ E_{rss}$$

or

$$6.0\ g(\theta)\ \sqrt{P_{kw}}$$

For all situations on or after January 4, 1982, Q is the greater of the following quantities:

$$0.025\ g(\theta)\ E_{rss}$$

or

$$10.0\ g(\theta)\ \sqrt{P_{kw}}$$

4. Section 73.150(b)(1) is amended to redescribe Eq. 3, Eq. 4, and Eq. 5 as Eq. 2, Eq. 3, and Eq. 4, respectively.

5. Section 73.150(b)(6) is redefined as Section 73.150(b)(7), and a new Section 73.150(b)(6) is added as follows:

Section 73.150 * * *
(a) * * *
(b) * * *

(6) The values used in specifying the parameters which describe the array must be specified to no greater precision than can be achieved with available monitoring equipment. Use of greater precision raises a rebuttable presumption of instability of the array. Following are acceptable values of precision; greater precision may be used only upon showing that the monitoring equipment to be installed gives accurate readings with the specified precision.

(i) Field Ratio: 3 significant figures.

(ii) Phasing: to the nearest 0.1 degree.

(iii) Orientation (with respect to a common point in the array, or with respect to another tower): to the nearest 0.1 degree.

(iv) Spacing (with respect to a common point in the array, or with respect to another tower): to the nearest 0.1 degree.

(v) Electrical Height (for all parameters listed in Section 73.160): to the nearest 0.1 degree.

(vi) Theoretical RMS (to determine pattern size): 4 significant figures.

(vii) Additional Requirements relating to modified standard patterns appear in Section 73.152(b)(5).

6. A new subsection (c) is added to Section 73.150 as follows:

(c) Sample calculations for the theoretical and standard radiation follow. Assume a five kilowatt (nominal power) station with a theoretical RMS of 685 mV/m at one kilometer. Assume that it is an in-line array consisting of three towers. Assume the following parameters for the towers:

| Tower | Field Ratio | Relative Phasing | Relative Spacing | Relative Orientation |
|---|---|---|---|---|
| 1 | 1.0 | -128.5 | 0.0 | 0.0 |
| 2 | 1.89 | 0.0 | 110.0 | 285.0 |
| 3 | 1.0 | 128.5 | 220.0 | 285.0 |

Assume that tower 1 is a typical tower with an electrical height of 120 degrees. Assume that tower 2 is top-loaded in accordance with the method described in Section 73.160(b)(2) where A is 120 electrical degrees and B is 20 electrical degrees. Assume that tower 3 is sectionalized in accordance with the method described in Section 73.160(b)(3) where A is 120 electrical degrees, B is 20 electrical degrees, C is 220 electrical degrees, and D is 15 electrical degrees.

The multiplying constant will be 323.6.

Following is a tabulation of part of the theoretical pattern:

| Azimuth | 0 | 30 | 60 | Vertical angle |
|---|---|---|---|---|
| 0 | 15.98 | 62.49 | 68.20 | |
| 105 | 1225.30 | 819.79 | 234.54 | |
| 235 | 0.43 | 18.46 | 34.56 | |
| 247 | 82.62 | 51.52 | 26.38 | |

If we further assume that the station has a standard pattern, we find that Q, for $\theta = 0$, is 22.36.

Following is a tabulation of part of the standard pattern:

| Azimuth | 0 | 30 | 60 | Vertical angle |
|---|---|---|---|---|
| 0 | 28.86 | 68.05 | 72.06 | |
| 105 | 1286.78 | 860.97 | 246.41 | |
| 235 | 23.48 | 26.50 | 37.18 | |
| 247 | 89.87 | 57.03 | 28.87 | |

The RMS of the standard pattern in the horizontal plane is 719.63 mV/m at one kilometer.

III. Section 73.152 is amended to read as follows:

Section 73.152 Modification of Directional Antenna Data

(a) If, after construction and final adjustment of a directional antenna, a measured inverse distance field in any direction exceeds the field shown on the standard radiation pattern for the pertinent mode of directional operation, an application shall be filed, specifying a modified standard radiation pattern and/or such changes as may be required in operating parameters so that all measured effective fields will be contained within the modified standard radiation pattern.

(b) Normally, a modified standard pattern is not acceptable at the initial construction permit stage, before a proof-of-performance has been completed. However, in certain cases, where it can be shown that modification is necessary, a modified standard pattern will be acceptable at the initial construction permit stage. Follouing is a non-inclusive list of items to be considered in determining whether a modification is acceptable at the initial construction permit stage:

(1) When the proposed pattern is essentially the same as an existing pattern at the same antenna site. (e.g., A DAD-D station proposing to become a DA-1 station.)

(2) Excessive reradiating structures, which should be shown on a plat of the antenna site and surrounding area.

(3) Other environmental factors; they should be fully described.

(4) Judgment and experience of the engineer preparing the engineering portion of the application. This must be supported with a full discussion of the pertinent factors.

(c) The following general principles shall govern the situations in subsections (a) and (b) in this Section:

(1) Where a measured field in any direction will exceed the authorized standard pattern, the license application may specify the level at which the input pouer to the antenna shall be limited to maintain the measured field at a value not in excess of that shown on the standard pattern, and shall specify the common point current corresponding to this power level. This value of common point current will be specified on the license for that station.

(2) Where any excessive measured field does not result in objectionable interference to another station, a modification of construction permit application may be submitted with a modified standard pattern encompassing all measured fields. The modified standard pattern shall supersede the previously submitted standard radiation pattern for that station in the pertinent mode of directional operation. Following are the possible methods of creating a modified standard pattern:

(i) The modified pattern may be computed by making the entire pattern larger than the original pattern (i.e., have a higher RMS value) if the measured fields systematically exceed the confines of the original pattern. The larger pattern shall be computed by using a larger multiplying constant, k, in the theoretical pattern equation (Eq. 1) in Section 73.150(b)(1).

(ii) Where the measured field exceeds the pattern in discrete directions, but objectionable interference does not result, the pattern may be expanded over sectors including these directions. When this "augmentation" is desired, it shall be achieved by application of the following equation:

$$E(\phi,\theta)_{aug} = \frac{\sqrt{\{E(\phi\theta)_{std}\}^2 + A\{g(\theta)\ cos\ (180\ DA\ \}^2}}{S}$$

where:

$E(\phi,\theta)_{std}$ is the standard pattern field at some particular azimuth and elevation angle, before augmentation, computed pursuant to Eq. 2, Section 73.150(b)(1)(i).

$E(\phi,\theta)_{aug}$ is the field in the direction specified above, after augmentation.

$A = E(\phi',0)^2_{aug} = E(\phi',0)^2_{std}$ in which $\phi'$ is the central azimuth of augmentation. $E(\phi',0)_{aug}$ and $E(\phi',0)_{std}$ are the fields in the horizontal plane at the central azimuth of augmentation.

Note: "A" must be positive, except during the process of converting non-standard patterns to standard patterns pursuant to the *Report and Order in Docket No. 21473,* and in making minor changes to stations bith patterns developed during the conversion. However, even when "A" is negative, "A" cannot be so negative that $E(\phi',\theta)_{aug}$ is less than $E(\phi,\theta)_{th}$ at any azimuth or vertical elevation angle.

$g(\theta)$ is defined in Section 73.150(b)(1)(i).

S is the angular range, or "span", over which augmentation is applied. The span is centered on the central azimuth of augmentation. At the limits of the span, the augmented pattern merges into the unaugmented pattern. Spans may overlap.

$D_A$ is the absolute horizontal angle between the azimuth at which the augmented pattern value is being computed and the central azimuth of augmentation. ($D_A$ cannot exceed ½ S).

In the case where there are spans which overlap, the above formula shall be applied repeatedly, once for each augmentation, in ascending order of central azimuth of augmentation, beginning with zero degrees representing true North. Note that, when spans overlap, there will be, in effect, an augmentation of an augmentation. And, if the span of an earlier augmentation overlaps the central azimuth of a later augmentation, the value of "A" for the later augmentation will be different than the value of "A" without the overlap of the earlier span.

(iii) A combination of (i) and (ii), above, with (i) being applied before (ii) is applied.

(3) A Modified Standard Pattern shall be specifically labeled as such, and shall be plotted in accordance with the requirements of subparagraph (2) of paragraph (b) of Section 73.150. The effective (RMS) field intensity in the horizontal plane of $E(\phi,\theta)_{std}$, $E(\phi,\theta)_{th}$, and the root sum square (RSS) value of the inverse fields of the array elements (derived from the equation for $E(\phi,\kappa)_{th}$), shall be tabulated on the page on which the horizontal plane pattern is plotted. Where sector augmentation has been employed in designing the modified pattern, the direction of maximum augmentation (i.e., the central azimuth of augmentation) shall be indicated on the horizontal plane pattern for each augmented sector, and the limits of each sector shall also be shown. Field values within an augmented sector, computed prior to augmentation, shall be depicted by a broken line.

(4) There shall be submitted, for each modified standard pattern, complete tabulations of final computed data used in plotting the pattern. In addition, for each augmented sector, the central azimuth of augmentation, span, and radiation at the central azimuth of augmentation ($E(\phi,\kappa)_{aug}$) shall be tabulated.

(5) The parameters used in computing the modified standard pattern shall be specified with realistic precision. Following is a list of the maximum acceptable precision:

(i) Central Azimuth of Augmentation: to the nearest 0.1 degree.

(ii) Span: to the nearest 0.1 degree.

(iii) Radiation at Central Azimuth of Augmentation: 4 significant figures.

(d) Sample calculations for a modified standard pattern follow. First, assume the existing standard pattern in Section 73.150(c). Then, assume the following augmentation parameters:

| Augmentation Number | Central Azimuth | Span | Radiation at Central Azimuth |
|---|---|---|---|
| 1 | 110 | 40 | 1300 |
| 2 | 240 | 50 | 52 |
| 3 | 250 | 10 | 130 |

Following is a tabulation of part of the modified standard pattern:

| Azimuth | 0 | 30 | 60 | Vertical angle |
|---|---|---|---|---|
| 0 | 28.86 | 68.05 | 72.06 | |
| 105 | 1299.42 | 872.14 | 254.21 | |
| 235 | 39.00 | 35.74 | 38.71 | |
| 247 | 100.47 | 66.69 | 32.78 | |

IV. A new Section 73.160 is proposed to be added as follows:

Section 73.160 Vertical plane radiation characteristics, $f(\theta)$

(a) The vertical plane radiation characteristics show the relative field being radiated at a given vertical angle, with respect to the horizontal plane. The vertical angle, represented as $\theta$, is 0 degrees in the horizontal plane, and 90 degrees when perpendicular to the horizontal plane. The vertical plane radiation characteristic is referred to as $f(\theta)$. The generic formula for $f(\theta)$ is:

$$f(\theta) = E(\theta)/E(0)$$

where:

$E(\theta)$ is the radiation from the tower at angle $\theta$.
$E(0)$ is the radiation from the tower in the horizontal plane.

(b) Listed below are formulas for $f(\theta)$ for several common towers.

(1) For a typical tower, which is not top-loaded or sectionalized, the following formula shall be used:

$$f(\theta) = \frac{\cos(G \sin\theta) - \cos G}{(1 - \cos G)\cos\theta}$$

where G is the electrical height of the tower, not including the base insulator and pier. (In the case of a folded unipole tower, the entire radiating structure's electrical height is used.)

(2) For a top-loaded tower, the following formula shall be

used:

$$f(\theta) = \frac{\cos B \cos(A \sin\theta) - \sin\theta \sin B \sin(A \sin\theta) - \cos(A + B)}{\cos\theta\,(\cos B - \cos(A + B))}$$

where:

A is the physical height of the tower, in electrical degrees, and

B is the difference, in electrical degrees, between the apparent electrical height (G, based on current distribution) and the actual physical height.

G is the apparent electrical height: the sum of A and B; A + B.

See Figure 1 of this Section.

(3) For a sectionalized tower, the following formula shall be used:

$$f(\theta) = \frac{\{\sin\Delta\,[\cos B \cos(A \sin\theta) - \cos G] + \sin B\,[\cos D \cos(C \sin\theta) - \sin\theta \sin D \sin(C \sin\theta) - \cos\Delta \cos(A \sin\theta)]\}}{\cos\theta\,[\sin\Delta\,(\cos B - \cos G) + \sin B\,(\cos D - \cos\Delta)]}$$

where:

A is the physical height, in electrical degrees, of the lower section of the tower.

B is the difference between the apparent electrical height (based on current distribution) of the lower section of the tower and the physical height of the lower section of the tower.

C is the physical height of the entire tower, in electrical degrees.

D is the difference between the apparent electrical height of the tower (based on current distribution of the upper section) and the physical height of the entire tower. D will be zero if the sectionalized tower is not top-loaded.

G is the sum of A and B; A + B.

H is the sum of C and D; C + D.

Δ is the difference betbeen H and A; H - A.

See Figure 2 of this Section.

(c) One of the above f(θ) formulas *must* be used in computing radiation in the vertical plane, unless the applicant submits a special formula for a particular type of antenna. If a special formula is submitted, it must be accompanied by a complete derivation and sample calculations. Submission of values for f(θ) only in a tabular or graphical format (i.e., without a formula) is not acceptable.

(d) Following are sample calculations. (The number of significant figures shown here should *not* be interpreted as a limitation on the number of significant figures used in actual calculations.)

(1) For a typical tower, as described in subsection (b)(1), assume that G = 120 electrical degrees:

| θ | f(θ) |
|---|---|
| 0 | 1.0000 |
| 30 | 0.7698 |
| 60 | 0.3458 |

(2) For a top-loaded tower, as described in subsection (b)(2), assume A = 120 electrical degrees, B = 20 electrical degrees, and G = 140 electrical degrees (120 + 20):

| θ | f(θ) |
|---|---|
| 0 | 1.0000 |
| 30 | 0.7364 |
| 60 | 0.2960 |

(3) For a sectionalized tower, as described in subsection (b)(3), assume A = 120 electrical degrees, B = 20 electrical degrees, C = 220 electrical degrees, D = 15 electrical degrees, G = 140 electrical degrees (120 + 20), H = 235 electrical degrees (220 + 15), and Δ = 115 electrical degrees (235-120):

| θ | f(θ) |
|---|---|
| 0 | 1.0000 |
| 30 | 0.5930 |
| 60 | 0.1423 |

V. A new sub-section (f) is added to Section 73.181:

(f) The Commission is in the process of converting its standards to the metric system. This process will be gradual, with some of our standards and other requirements in the metric system while other of our standards and requirements may remain non-metric. Therefore, parties involved with AM broadcast stations and applications therefore should take extra care to avoid problems resulting from the mixing of the two systems.

(1) Parties submitting directional antenna patterns pursuant to Sections 73.150 and 73.152 (standard patterns and modified standard patterns) must submit patterns which are tabulated and plotted using units of millivolts per meter at one mile prior to January 4, 1982. Beginning on January 4, 1982, such patterns must be tabulated and plotted using units of millivolts per meter at one kilometer. Applications which are amended should use the units in effect as of the day of submission of the amendment. Applications which are on file prior to January 4, 1982, need not be amended solely for

the purpose of conversion to the metric units. Applications which are submitted using the wrong units will be returned unless they are promptly amended to use the correct units.

(2) The Rules and the application forms (Forms 301, 302, 340, and 341) will be amended periodically as other changes to the metric system are made. Interested parties should check carefully to insure that the correct units are being used.

VI. Section 73.182(a)(3)(ii) is amended to read as follows:

(a) * * *
(1) * * *
(2) * * *
(3) * * *

(i) * * *

(ii) Class III-B stations, which operate with a nighttime nominal power of 500 watts and a daytime nominal power of no less than 500 watts and no greater than 5 kilowatts, and are normally protected to the 4000 uV/m contour nighttime and the 500 uV/m contour daytime.

Note: * * *

VII. Section 73.185 is amended to read as follows:

Section 73.185 Computation of interference and overlap.

(a) Measured values of radiation are not to be used in calculating overlap, interference, and coverage.

(1) In the case of an antenna which is intended to be non-directional in the horizontal plane, an ideal non-directional radiation pattern shall be used in determining interference, overlap, and coverage, even if the antenna is not actually non-directional.

(2) In the case of an antenna which is directional in the horizontal plane, the radiation uhich shall be used in determining interference, overlap, and coverage is that calculated pursuant to Section 73.150 or Section 73.152, depending on whether the station has a standard or modified standard pattern.

(3) In the case of calculation of interference or overlap to (not from) a foreign station, the notified radiation shall be used, even if the notified radiation differs from that in subparagraphs (1) or (2).

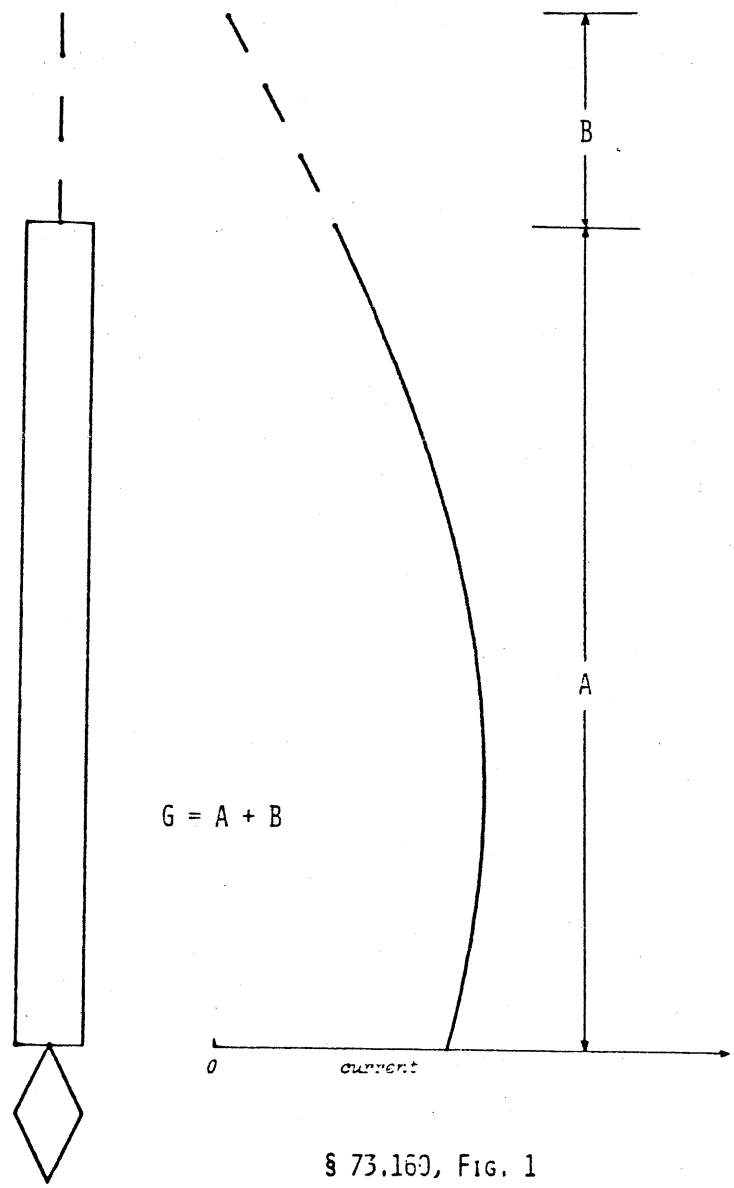
(b) * * *
(c) * * *
(d) * * *
(e) * * *
(f) * * *
(g) * * *
(h) In the case of an antenna which is intended to be non-directional in the horizontal plane, the vertical distribution of the relative fields should be computed pursuant to Section 73.160. In the case of an antenna which is directional in the horizontal plane, the vertical pattern in the great circle direction towards the point of reception in question must first be calculated. In cases where the radiation in the vertical plane, in the pertinent azimuth, contains a large lobe at a higher angle than the pertinent angle for one reflection, the method of calculating interference will not be restricted to that just described, but each such case will be considered on the basis of the best knowledge available.
(i) * * *
(j) * * *
Note * * *

VIII. The title and sub-section (a) of Section 73.186 is amended to read as follows:

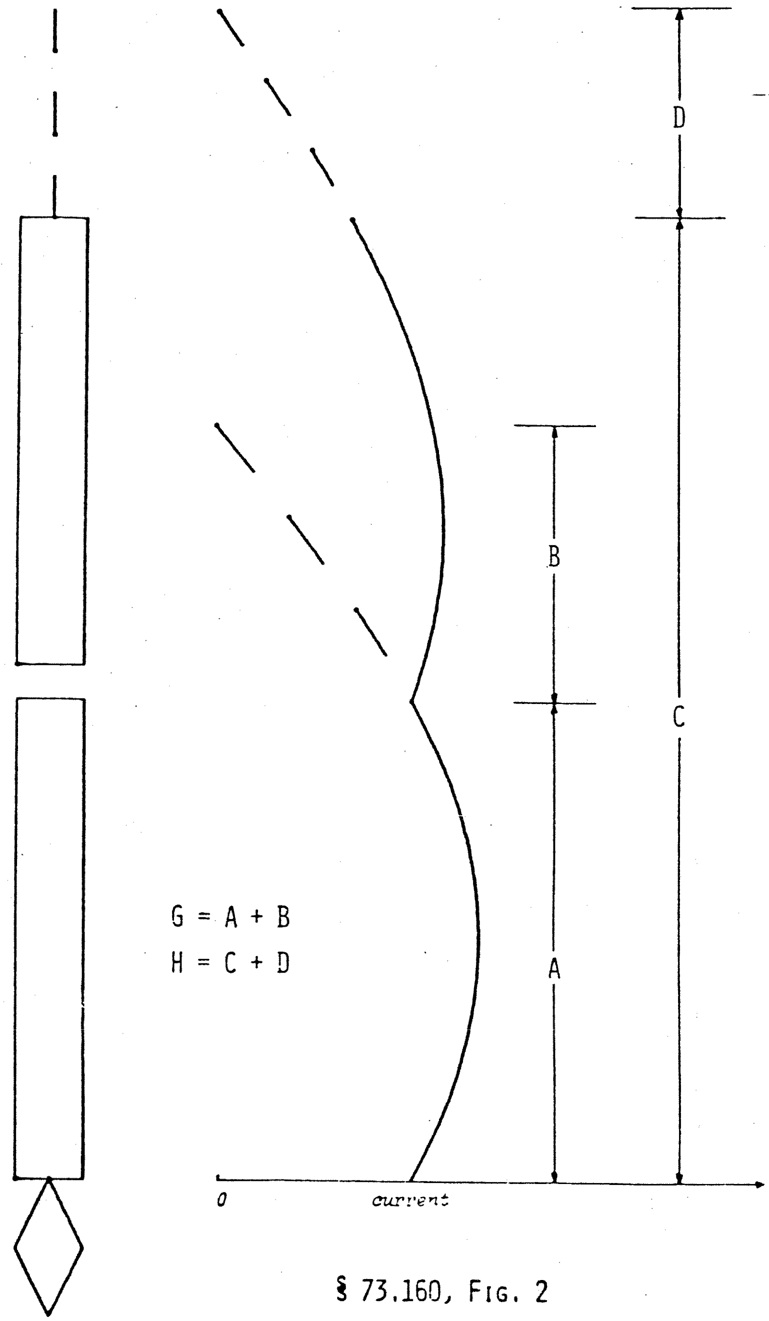
Section 73.186 Establishment of effective field at one mile.

(a) Section 73.45 provides that certain minimum field strengths are acceptable in lieu of the required minimum physical heights of the antennas proper. Also, in other situations, it may be necessary to determine the effective field. The following requirements shall govern the taking and submission of data on the field strength produced:
(1) * * *
(2) * * *
(3) * * *
(4) * * *
(5) * * *
(6) * * *
(b) * * *

* * *




§ 73.160, Fig. 1




§ 73.160, FIG. 2

Appendix II

The following guidelines are to be applied in converting AM broadcast stations to standard patterns.

1. Existing standard and augmented patterns.

A. Convert to metric system, on January 4, 1982, using existing parameters.

2. Other existing patterns.

A. Check parameters such as electrical spacing and height to ensure that they are correct for the authorized frequency. If incorrect, use the physical spacing and height to compute the proper electrical values for the authorized frequency.

B. Compute the standard pattern using the theoretical RMS to determine the pattern size. The normal Q shall be used in computing the standard pattern.

C. Examine the measured pattern, the plotted theoretical pattern with MEOV, and the appropriate construction permit to determine the arcs in which the measured radiation and/or MEOV (including the MEOV on outstanding construction permits) exceeds the standard pattern, as computed in B, above. In these arcs, augmentation shall be applied as follows:

(1) The augmented value shall be as great as the measured value at each azimuth, insofar as possible. It is more important that the augmentation cover the measured values on the azimuths at which proof of performance measurements were made; it is less important that the augmentation cover the values on the measured pattern which are the result of "smoothing in" between measured radials.

(2) In arcs where the MEOV exceeds the measured and/or standard pattern values, the augmented values shall normally be no greater than the MEOV at any azimuth. However, in those cases where the only MEOV at an azimuth is a value specified on a construction permit, or where the MEOV specified on the construction permit is greater than the MEOV shown on the pattern, the MEOV on the construction permit can be used with a span of 10 degrees.

(3) In arcs where the existing MEOV exceeds the measured and/or standard pattern values, the maximum possible value which can be retained at each azimuth is the greater of the following two values:

RADI = (RMS)[(-0.05)(Meas/RMS) + 0.1] + Meas

where RMS is the measured pattern RMS, and Meas is the measured radiation at the desired azimuth.

RAD2 = (MEOV-Meas)[1.0-(MEOV-Meas)/(2 Meas)] + Meas

where MEOV is the MEOV at the desired azimuth, and Meas is the measured radiation at the desired azimuth.

Note: In each case, if the part in square brackets is less than zero, use zero.

(4) Augmentation shall be used as sparingly as possible.

(5) The span for each augmentation shall be at lease 10 degrees.

(6) The augmented pattern shall be developed so that the measured pattern RMS shall not fall below 85 percent of the augmented pattern RMS.

D. For Class I or Class II stations operating at night, which are co-channel with a U.S. Class I station: in the arcs in the direction of the 0.5 mV/m-50 percent skywave contour of the U.S. Class I station, the standard pattern of the Class I or II station shall be adjusted by use of either a lower Q or "negative augmentation" (or both) to reduce the standard pattern radiation to a value no greater than the MEOV or the measured radiation.

E. This section applies only in the event that we do not reach agreements with Canada and Mexico on the conversion to standard patterns:

For non-Class IV stations operating at night, in the direction of the protected service area of a non-U.S. Class I station, or in the direction of the site (plus and minus five degrees) of a non-U.S. non-Class I station, in which the standard pattern radiation exceeds the notified pattern radiation:

Then, the standard pattern of the non-Class IV station shall be adjusted by use of either a lower Q or "negative augmentation" (or both) to reduce the standard pattern radiation to a value no greater than the notified radiation or the measured radiation, whichever is greater.

F. Convert the standard pattern, as augmented, to the metric system on January 4, 1982.

3. Public Notice of Results.

A. As the patterns are converted, the results will periodically be made available via Public Notices distributed by the Commission's Public Information Office.

B. Any party (licensees, permittees, applicants, or others) may submit proposed corrections to the developed parameters within 30 days after release of the public notice. The proposed corrections should be submitted both to the Commission and to the contractor performing the conversion to standard patterns. In addition, if the request for modification is made by a party other than the licensee, the party must also notify the licensee. All requests for modifications must supply alternative parameters, as well as justification for the use of the alternative parameters.

C. If a modification is requested, the contractor will examine the request and either modify the parameters (with the issuance of another Public Notice) or supply a report to the Commission indicating why the contractor believes the original parameters are correct.

D. In the event that the contractor supplies a report to the Commission, Commission staff will examine both the request for the modified parameters and the contractor's report, and make a decision. (The Commission, not the contractor, will be the final arbiter in the event of a dispute.)

4. Pending applications.

The processing of pending applications will be stopped, individually, while each is converted. The method of conversion will be the same as for an existing operation. After its conversion, each application will be processed using the converted pattern. If interference develops (using the converted pattern) that did not exist prior to conversion, the application will be granted with the converted pattern, notwithstanding the interference. An amendment tendered after conversion of the corresponding application must use a standard pattern.

5. Precision of parameters.

Converted patterns which do not need correction of basic parameters (pursuant to 2(A) above, for example) will continue using these parameters, even if the precision is in excess of the specified precision in Sections 73.150(b)(6) and 73.152(b)(5).

If the existing parameters must be corrected or if new parameters must be assigned (adding augmentation, for example), the new and/or adjusted parameters shall have no greater precision than outlined in Sections 73.150(b)(6) and 73.152(b)(5).

APPENDIX III

```
*****************************************************************

   TTTTT    OOOO    W    W   RRRRR    EEEEE    FFFFF
     T     O    O   W    W   R    R   E        F
     T     O    O   W    W   RRRRR    EEEE     FFFF
     T     O    O   W WW W   R  R     E        F
     T     O    O   WW  WW   R   R    E        F
     T      OOOO    W    W   R    R   EEEEEE   F

*****************************************************************

SUBROUTINE TOWREF (N,DTEMP,DD,ATEMP,ALPHAD,ALPHA,D,NDA,KLM)

*****************************************************************

   THIS SUBROUTINE FINDS THE ADJUSTED SPACING AND ORIENTATION IN
        RADIANS (D,ALPHA) AND DEGREES (DD,ALPHAD) FOR THE TOWERS,
        BASED ON THE SPACING AND ORIENTATION IN DEGREES (DTEMP,
        ATEMP) AND A SIGNAL (NDA) INDICATING WHETHER DTEMP AND
        ATEMP REFER TO A COMMON ORIGIN OR THE PREVIOUS TOWER.

FOLLOWING IS A DESCRIPTION OF THE ARGUMENTS:

   N      -- AN INTEGER CONTAINING THE NUMBER OF TOWERS.
             THIS IS AN INPUT ARGUMENT.

   DTEMP  -- A FLOATING POINT ARRAY CONTAINING THE SPACING
             (IN DEGREES) FOR THE CORRESPONDING TOWER.  THIS IS AN
             INPUT ARGUMENT.

   DD     -- A FLOATING POINT ARRAY CONTAINING THE SPACING
             (IN DEGREES) FROM THE ORIGIN FOR THE CORRESPONDING
             TOWER.

   ATEMP  -- A FLOATING POINT ARRAY CONTAINING THE ORIENTATION
             (IN DEGREES) FOR THE CORRESPONDING TOWER.  THIS IS
             AN INPUT ARGUMENT.

   ALPHAD -- A FLOATING POINT ARRAY CONTAINING THE ORIENTATION
             (IN DEGREES) FROM THE ORIGIN FOR THE CORRESPONDING
             TOWER.

   ALPHA  -- A FLOATING POINT ARRAY CONTAINING THE ORIENTATION
             (IN RADIANS) FROM THE ORIGIN FOR THE CORRESPONDING
             TOWER.

   D      -- A FLOATING POINT ARRAY CONTAINING THE SPACING
             (IN RADIANS) FROM THE ORIGIN FOR THE CORRESPONDING
             TOWER.
```

```
      NDA    -- AN INTEGER ARRAY CONTAINING A ZERO OR ONE FOR EACH
                TOWER, INDICATING WHETHER THE SPECIFIED SPACING AND
                ORIENTATION (DTEMP AND ATEMP) ARE FROM THE COMMON
                ORIGIN OR FROM THE IMMEDIATELY PRECEEDING TOWER.
                A ZERO REFERS TO THE COMMON REFERENCE POINT, WHILE
                A ONE REFERS TO THE IMMEDIATELY PRECEEDING TOWER.

      KLM    -- AN INTEGER CONTAINING A ZERO OR ONE, INDICATING
                WHETHER ANY OF THE SPACINGS AND ORIENTATIONS REFER
                TO THE IMMEDIATELY PRECEEDING TOWER. KLM IS ZERO
                IF ALL SPACINGS AND ORIENTATIONS ARE WITH RESPECT
                TO THE COMMON REFERENCE POINT. KLM IS ONE IF AT
                LEAST ONE OF THE SET OF SPACINGS AND ORIENTATIONS
                IS WITH RESPECT TO THE IMMEDIATELY PRECEEDING TOWER.
                THIS IS USED TO DETERMINE WHETHER DD AND ALPHAD
                SHOULD BE PRINTED.

  ***************************************************************

  THE FOLLOWING STATEMENT IS THE FIRST STATEMENT

  ***************************************************************

  DATA DEGREE,RADIAN /57.29578,0.0174532925/
  DIMENSION DTEMP(N),DD(N),ATEMP(N),ALPHAD(N),NDA(N),ALPHA(N),D(N)

  ***************************************************************

  THE FOLLOWING STATEMENT IS THE FIRST EXECUTABLE STATEMENT

  ***************************************************************

  KLM=0

  DO 20 I=1,N
  ALPHA(I)=ATEMP(I)*RADIAN
  ORIENTATION IN RADIANS
  D(I)=DTEMP(I)*RADIAN
  SPACING IN RADIANS
  IF (NDA(I).NE.1) GO TO 10
  NDA=1 MEANS REF TO PREVIOUS TOWER
  KLM=1
  II=I-1
  TEMP1=D(I)*COS(ALPHA(I))+D(II)*COS(ALPHA(II))
  TEMP2=D(I)*SIN(ALPHA(I))+D(II)*SIN(ALPHA(II))
  D(I)=SQRT(TEMP1*TEMP1+TEMP2*TEMP2)
  ALPHA(I)=ATAN2(TEMP2,TEMP1)
  ALPHAD(I)=ALPHA(I)*DEGREE
  ADJ. ORIENT. IN DEGREES
  DD(I)=D(I)*DEGREE
  ADJ. SPACING IN DEGREES
  CONTINUE

  RETURN
  END
```